Test

Answer the questions below to the best of your knowledge, you may search them on the Web as well. For each question express how familiar you are with the topic of the question via a number between 1 and 10, with 1 indicating "very unfamiliar" and 10 "very familiar". **Be honest about it**, your assessment will help us shape the best course for you.

1. **Vectors**: Define the **scalar product** of two vectors. .
2. **Matrices (1)**: Define the **product** of two n x n matrices **A** and **B** and the **transpose** of a matrix
3. **Matrices (2)**: What are the **eigenvectors** and **eigenvalues** of a matrix?
4. **Statistics (1)**: What is the definition of **mean**, **median**, and **standard deviation**?
5. **Statistics (2)**: What is **Bayes theorem**? What is the **likelihood**?
6. **Statistics (3)**: Define a **discrete probability distribution** p_k (k=1, 2, 3, …). Define the **k-th moment of the distribution**. Define the **Bernoulli** and the **Poisson distribution**.
7. **Statistics (4):** Consider the power law distribution: $\mathbf{p(x) = C\ x^{-4}}$**,** defined for $x \geq 1$. What is the value of C?
8. **Statistics (5):** define the **generating function** of a discrete probability distribution p_k (k=1, 2, 3, …).
9. **Statistics (6):** Given two variables **X** and **Y**, both with **n** entries (x_1, x_2, …, x_n and y_1, y_2, …, y_n), define the **Pearson correlation coefficient** between them.
10. Consider the **differential equation**

    $$\frac{dS}{dt} = -\beta SI\frac{dI}{dt}$$

    which rules the dynamics of the **Susceptible-Infected-Susceptible (SIS) model of epidemic spreading**. Here S is the fraction of the population that is susceptible, I the fraction that is infected (so S+I =1). Please explain what the equation represents.